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(54) Title: PROCESS FOR THE PREPARATION OF BAEFL FRUIT POWDER

(57) Abstract: The present invention relates to the bael fruit powder and method for the preparation of the same. The present invention particularly relates to spray drying of formulated Bael fruit pulp to get a free flowing yellowish red dried powder having good shelf life.

PROCESS FOR THE PREPARATION OF Bael FRUIT POWDER

TECHNICAL FIELD

The present invention relates to the *bael* fruit powder and method for the preparation of 5 the same. The present invention particularly relates to spray drying of formulated *Bael* fruit pulp to get a free flowing yellowish red dried powder having good shelf life.

BACKGROUND AND PRIOR ARTS

Bael fruit is largely grown in northern states of India and due to its soothing and 10 refreshing effect, it is consumed as a serbhat especially during summer season. It is valued mainly for its characteristic flavour and also for its nutritional values. *Bael* pulp extracted from fresh *Bael* fruit undergoes deterioration at room temperature upon exposure to atmospheric conditions (microorganism, oxygen and high temperature). Dehydration is the best feasible method for the preservation of *Bael* fruit pulp.

The uses of the *Bael* fruit powder are:

- 15 1. *Bael* fruit powder is expected to have a lot of potential in confectionery and fruit beverage industry.
2. Dehydrated *Bael* fruit powder, which retains the natural flavour, besides good keeping quality, would lead to greater convenience and increased consumption.
3. Individual and institutional users would be relieved from the drudgery of extracting 20 pulp, which is tedious operation.
4. Further, it offers additional advantages such as less storage space, extended shelf life and availability throughout the year irrespective of the season.
5. It can be used in preparation of soft drinks, fruit juices, jams, jellies, candies, chocolates, milk-based drinks, ice-creams etc.

25 It is difficult to dry *Bael* fruit pulp because its pulp is highly viscous in nature and poses handling problems.

Reference can not be made to any other work, which is directly related to spray dried *Bael* fruit powder, since no reports are available on spray drying of *Bael* fruit pulp. However to draw analogy references are made in the following section about the 30 spray drying of liquids of high sugar content and viscous such as fruit juices and honey.

Reference can be made the work report by Susanta and Singh (Indian Food Packer, 1979, 33(5), 9-14), wherein they have described the preparation of *bael* fruit powder by drying the pulp with 2000 ppm SO₂ to a low moisture content and then it was ground. The process involves about 28 hours of drying, which is expected to affect

the organoleptic properties.

Reference can be made to the patent US 4112130, in which the inventors described the process for spray dried orange juice, they spray dried aqueous slurry of 65% solids (out of which orange solid constitute 50-85% and rest is food grade water dispersible or water soluble drying aid) to 4% under carefully controlled conditions. The inlet and outlet temperature of spray drier was 220-300°F and 145-205°F, respectively.

Reference can be made to the patents US 5118517, JP 56124367A2, and JP59082073A2 where in fruit juice was formulated with the addition of dextran (10-100%), cyclodextrin and palatinose, respectively and powder was produced by spray drying.

Reference can be made to the patent RU2136182C1, in which the inventors describe the method for the production of dried fruit juice by freeze drying of cut fruit and later it was grounded to powder state.

Reference can be made to the patent JP 62179370A2 in which the inventors describe the production of granular instant drink by dripping fruit juice containing 40-70% water content on powdery raw material (e.g. sugar powder) and then drying the wet granules with hot air (40-80°C).

Reference can be made to patent JP59085262, which describes a process using wax starch 1.2 to 1.4 times the weight of honey in terms of solid as drying aid. The mixture is diluted with water to obtain an approximate solid content of 25% w/w and then spray dried at inlet and outlet temperatures of 140 °C to 150 °C and 90°C to 95. °C, respectively. Honey content is less than 50% in the final dried product.

Another reference can be made to the patent JP5049417, where the inventors have described a method by regulating the pH of aqueous feed solution between 6.5 to 7.5 and then spray dried it to obtain the dried product. The purpose of neutralising is to reduce the thermoplasticity of sugary material by drying. The pH was regulated by addition of bases, which are acceptable from food point of view. According to the inventors, if necessary, antioxidant, carrier, partial dispersion can be mixed. The temperature conditions at inlet and outlet of 120°C to 200 °C and 70°C to 120 °C, respectively. Honey content is again about 50% in the powder.

OBJECT OF THE INVENTION

The main object of the present invention relates to the *bael* fruit powder and method for the preparation of the same.

Another object of the present invention relates to the to obtain a spray dried formulated *Bael* fruit pulp to get a free flowing yellowish red dried powder having good shelf life.

SUMMARY OF THE INVENTION

The present invention provides a process for the preparation of *Bael* fruit powder. The prepared *Bael* fruit powder has the characteristic flavour of *Bael* fruit with acceptable colour and shelf life. Further the bael powder has good moisture content and about 75% carbohydrate content

BRIEF DESCRIPTION OF ACCOMPANYING DRAWINGS

Figure 1.: Schematic representation of spray drying systems
 10 Figure 2.: Flow chart for production of bael fruit powder

DESCRIPTION OF THE INVENTION

The object of the present invention is to develop a process for the preparation of *Bael* fruit powder. Another object of the present invention is to produce *Bael* fruit powder, which has the characteristic flavour of *Bael* fruit with acceptable colour and shelf life.

15 In the drawing accompanying the specification, Figure 1, represents the schematic diagram of the spray drying systems used for the production of *Bael* fruit powder. The spray drying system consists of insulated drying chamber (1) fitted with nozzle type atomiser (2) and air distributor (3). The solid material present in the air solid stream is separated in cyclone separator (4) and gets collected in the collecting vessel (5). Hot air, 20 heat by the heat exchanger (6) enters the drying chamber from the top. Feed from the feed vat (7) enters the chamber along with the compressed air through nozzle type atomiser (2). Suction fan (8) facilitates the movement of solid air stream from the drying chamber to the cyclone and to the atmosphere. The flow chart for the production of *Bael* fruit powder is given Figure 2.

25 The formulation of the *Bael* fruit powder is the critical step, which enabled the preparation of free flowing spray dried of *Bael* fruit powder. The characteristics of the spray dried *Bael* fruit powder are given in Table 1.

Table 1: Characteristics of spray dried *Bael* fruit powder

| | | |
|----|--|------------|
| 30 | Total carbohydrate (as Glucose equivalent) | 75.5±2.0% |
| | Moisture content | 2.31±0.05% |
| | Colour measurement | |
| | L-value | 42.05 |
| | a-value | 0.55 |
| | b-value | 13.47 |
| 35 | pH (5% w/v at 27 °C) | 5.60 |

Accordingly, the main embodiment of the present invention relates to an improved process for the preparation of bael fruit powder, said process comprising the steps of:

- (a) extracting *Bael* fruit pulp,
- 5 (b) mixing the pulp with water in the ratio of about 1:3 proportion,
- (c) filtering the diluted pulp obtained from step (b),
- (d) mixing the filtered pulp of step (c) with anti-caking agent, $MgCO_3$ is in the range of about of about 0.5 to 3.0g/kg of *Bael* fruit diluted pulp and water to get a final concentration of 12 °brix,
- 10 (e) homogenising the mixture obtained from step (d) at pressure in the range of about 2000-7000 psi,
- (f) drying the homogenised juice using spray dried at a controlled inlet temperature in the range of about 120-180°C and outlet temperature of about 70-100°C, and
- 15 (g) collecting the dry *Bael* fruit powder at dehumidified conditions having a temperature is in the range of about 20-30°C and relative humidity is in the range of about 10-15%.

Another embodiment of the present invention relates to the anticaking agent $MgCO_3$ in step (d) wherein anticaking agent $MgCO_3$ is in the range of about 1.0 to 2.0g/kg of *Bael* fruit diluted pulp.

20 Still another embodiment of the present invention relates to the final concentration of *Bael* fruit diluted pulp and water in step (d) wherein final concentration of *Bael* fruit diluted pulp and water is about 10°brix.

Yet another embodiment of the present invention relates to the pressure in the step (e) wherein pressure is in the range of 2500-5000psi.

25 One more embodiment of the present invention relates to the inlet and outlet temperature in step (f) wherein inlet and outlet temperature is in the range of about 140°C- 170°C and 90°C, respectively.

Still another embodiment of the present invention relates to the dehumidified conditions in step (g) wherein dehumidified conditions are having a temperature of about 25°C and relative humidity of about 10%.

30 Yet another embodiment of the present invention relates to the addition of anticaking agent $MgCO_3$ wherein anticaking agent $MgCO_3$ retards the caking of the dried powder.

One more embodiment of the present invention relates to the addition of anticaking agent $MgCO_3$ wherein addition of anticaking agent $MgCO_3$ provides a free flowing Bael fruit powder.

Another embodiment of the present invention relates to the total carbohydrate content 5 wherein total carbohydrate content of the bael fruit powder is in the range of about 70 to 85%.

Still another embodiment of the present invention relates to the total carbohydrate content of the bael fruit powder is about $75.5 \pm 0.05\%$.

One more embodiment of the present invention relates to the moisture content of the 10 bael fruit powder wherein moisture content of the bael fruit powder is in the range of about 2 to 3%.

Yet another embodiment of the present invention relates to the moisture content of the bael fruit powder wherein the moisture content of the bael fruit is about $2.3 \pm 0.05\%$.

Another embodiment of the present invention relates to the colour measurement of the 15 bael fruit powder wherein the colour of the bael fruit powder has L-value is in the range of about 40-45; a-value is in the range of about 0.5 to 1.2; b-value is in the range of about 10-20.

Yet another embodiment of the present invention relates to the colour of the bael fruit powder wherein the colour of the bael fruit powder is about L-value of about 42.05; a-value of about 0.55; b-value of about 13.47 and

Still another embodiment of the present invention relates to the pH wherein the pH is in the range of about 5-6.

Another embodiment of the present invention relates to the pH wherein the pH is about 5.6.

25 The following examples are given by way of illustration of the present invention and should not be construed to limit the scope of the present invention.

EXAMPLES

EXAMPLE 1

The 2 kg of freshly extracted *Bael* fruit pulp was taken and filtered using muslin cloth 30 after addition of water in proportion 1:3, in order to remove fibre and extraneous material. The filtered pulp was checked for total solids and was found to be 10 °brix. The diluted *Bael* fruit pulp was taken in a steel vessel and mixed with anti-caking agent ($MgCO_3$) 1.0g/kg. The *Bael* fruit pulp, thus obtained, was homogenised and finally spray dried at a feed flow rate of 50 ml/min. The inlet and outlet temperature of the

spray drier was 140 °C and 90 °C, respectively.

The product obtained was yellowish cream in colour with characteristic flavour of *Bael* fruit.

EXAMPLE 2

5 The 2 kg of freshly extracted *Bael* fruit pulp was taken and filtered using muslin cloth after addition of water in the proportion 1:3, in order to remove fibre and extraneous material. The filtered pulp was checked for total solids and was found to be 10 °brix. The diluted *Bael* fruit pulp was taken in a steel vessel and mixed with anti-caking agent ($MgCO_3$) 2.0g/kg. The *Bael* fruit pulp, thus obtained, was homogenised and finally
10 spray dried at a feed flow rate of 50 ml/min. The inlet and outlet temperature of the spray drier was 140 °C and 90 °C, respectively.

The product obtained was free flowing, yellowish cream in colour with characteristic flavour of *Bael* fruit. Addition of anti-caking agent in this range resulted in free flowing *Bael* fruit powder.

15 ADVANTAGES

1. Process is easy to scale up.
2. The product is free flowing, yellowish cream in colour with characteristic flavour of *Bael* fruit.
3. The spray dried *Bael* fruit powder can be used in preparation of soft drinks, fruit
20 juices, jams, jellies, candies, chocolates, milk-based drinks, ice-creams etc.
4. *Bael* fruit powder may find its application in confectionery and fruit beverage industry. Dehydrated *Bael* fruit powder retains the natural flavour, besides good keeping quality, would lead to greater convenience and increased consumption.
5. Consumers will be relieved from the task of *Bael* fruit pulp extracting pulp and they
25 can use this product throughout the year irrespective of the season.
6. The Product has permissible additives and shown a shelf-life of more than six months when packed in laminate of 12 μm polyester/ 12 μm aluminum foil polyester/ 37 μm low density polyethylene pouches under normal storage conditions.
- 30 7. Sensory studies indicated that the aroma and taste of juice prepared from this product was similar to that of fresh juice. Further, sensory acceptability of the product was quite high.
8. Further, it offers additional advantages such as less storage space,

We claim

1. An improved process for the preparation of bael fruit powder, said process comprising the steps of:
 - 5 (a) extracting *Bael* fruit pulp,
 - (b) mixing the pulp with water in the ratio of about 1:3 proportion,
 - (c) filtering the diluted pulp obtained from step (b),
 - (d) mixing the filtered pulp of step (c) with anti-caking agent, $MgCO_3$ is in the range of about of about 0.5 to 3.0g/kg of *Bael* fruit diluted pulp and water to get a final concentration of 12 °brix,
 - 10 (e) homogenising the mixture obtained from step (d) at pressure in the range of about 2000-7000 psi,
 - (f) drying the homogenised juice using spray dried at a controlled inlet temperature in the range of about 120-180°C and outlet temperature of about 70-100°C,
 - 15 (g) collecting the dry *Bael* fruit powder at dehumidified conditions having a temperature in the range of about 20-30°C and relative humidity in the range of about 10-15%.
2. A process as claimed in claim 1, wherein, anticaking agent $MgCO_3$ in step (d) is in the range of about 1.0 to 2.0g/kg of *Bael* fruit diluted pulp.
3. A process as claimed in claim 1, wherein, final concentration of *Bael* fruit diluted pulp and water in step (d) is about 10° brix.
4. A process as claimed in claim 1, wherein, pressure in the step (e) is in the range of 2500-5000psi.
- 25 5. A process as claimed in claim 1, wherein, inlet and outlet temperature in step (f) is in the range of about 140°C- 170°C and 90°C, respectively.
6. A process as claimed in claim 1, wherein, the humidified conditions in step (g) is having a temperature of about 25°C and relative humidity of about 10%.
7. A process as claimed in claim 1, wherein, addition of anticaking agent $MgCO_3$ retards the caking of the dried powder.
- 30 8. A process as claimed in claim 1, wherein, addition of anticaking agent $MgCO_3$ provides a free flowing *Bael* fruit powder.
9. A process as claimed in claim 1, wherein, the total carbohydrate content of the bael fruit powder is in the range of about 75 to 80%.

10. A process as claimed in claim 9, wherein, the total carbohydrate content of the bael fruit powder is about $75.5 \pm 0.05\%$.
11. A process as claimed in claim 1, wherein, moisture content of the bael fruit powder is in the range of about 2 to 3%.
- 5 12. A process as claimed in claim 11, wherein, moisture content of the bael fruit powder is about $2.3 \pm 0.05\%$.
13. A process as claimed in claim 1, wherein, the colour of the bael fruit powder has L-value of in the range of about 40-45; a-value of about 0.50 to about 1.2; b-value is in the range of about 10-20.
- 10 14. A process as claimed in claim 13, wherein, the colour of bael fruit powder is has L-value of about 42.05; a-value of about 0.55; b-value of about 13.47 and
15. A process as claimed in claim 1, wherein, pH is in the range of about 5-6.
16. A process as claimed in claim 15, wherein pH is about 5.6.

1/2.

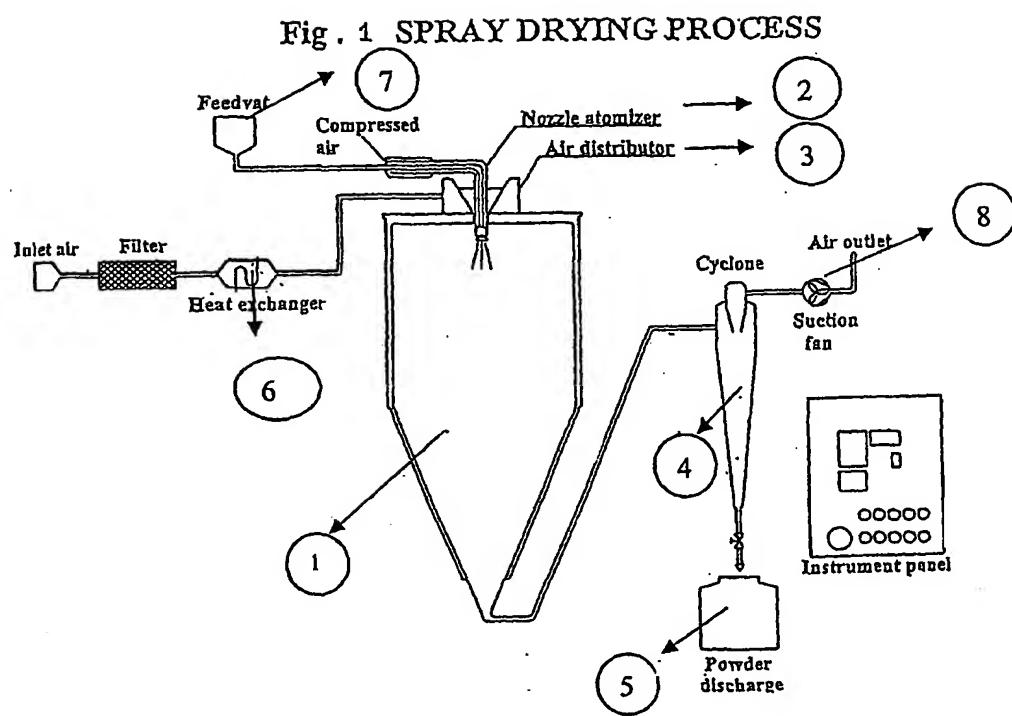


Figure 1

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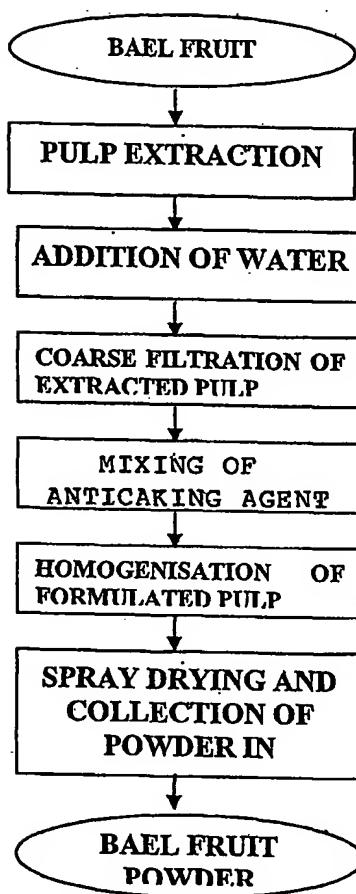


Figure 2

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IN 03/00433

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A23L2/10 A23L2/39 A23L2/52 A23B7/026 A23B7/022

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A23L A23B A23K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data, FSTA, BIOSIS, MEDLINE, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|-----------------------|
| A | <p>DATABASE FSTA 'Online! INTERNATIONAL FOOD INFORMATION SERVICE (IFIS), FRANKFURT-MAIN, DE; 2000, SHRESTHRA G L: "Processing of wild Bael fruit for rural employment and income generation." XP002296547 Database accession no. 2001-00-J0481 abstract & FOOD CHAIN, vol. 27, 2000, pages 15-17, GREEN ENERGY MISSION/NEPAL, PO BOX 10647, KATHMANDU, NEPAL. FAX +977 1 410857</p> <p style="text-align: center;">-/-</p> | 1-16 |

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the International filing date
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- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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INTERNATIONAL SEARCH REPORT

International Application No

PCT/IN 03/00433

| C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT | | |
|--|--|-----------------------|
| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| A | <p>DATABASE FSTA 'Online! INTERNATIONAL FOOD INFORMATION SERVICE (IFIS), FRANKFURT-MAIN, DE; 1979, ROY S K ET AL: "(In 'Proceedings of the First Indian Convention of Food Scientists and Technologists' ((see FSTA (1979) 11 12A871)).)" XP002296548 Database accession no. 79-3-12-j2075 abstract & INDIAN AGRIC. RES. INST., NEW DELHI, INDIA, 1979, INDIA</p> <p>-----</p> | 1-16 |
| A | <p>US 4 664 920 A (MCKAY RANDAL P ET AL) 12 May 1987 (1987-05-12) column 1, line 66 - column 3, line 40; claims; examples</p> <p>-----</p> | 1-16 |
| A | <p>US 4 112 130 A (GUPTA ASHIS S) 5 September 1978 (1978-09-05) cited in the application column 1 - column 2, line 22; claims; examples</p> <p>-----</p> | 1-16 |
| A | <p>US 2002/102336 A1 (MANN DOUGLAS G) 1 August 2002 (2002-08-01) page 0019 - page 0023; claims; examples</p> <p>-----</p> | 1-16 |

INTERNATIONAL SEARCH REPORT

International Application No

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